

AB: Practice Free Response. No Calculator. Show all work below line.

1. Let $f(x) = \begin{cases} x^2, & x \leq 1 \\ 2x, & x > 1 \end{cases}$

- a. Use the alternate form definition to find the left-hand derivative of f at $x = 1$ if it exists.
 - b. Use the alternate form definition to find the right-hand derivative of f at $x = 1$ if it exists.
 - c. Is $f(x)$ differentiable at $x = 1$? Explain.
 - d. Determine if $f(x)$ is continuous at $x = 1$. Give conclusion based on the 3-step definition.
 - e. Sketch a graph of $f(x)$. Be sure to label it.
 - f. On the same set of axes, sketch a graph of $f'(x)$. Use a different line quality, and be sure to label it.
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2. A particle moves along a horizontal line with position equation $s(t) = (3t - 2)(t - 5)$ with $s(t)$ measured in feet t measured in seconds and $t \geq 0$.
- What is the initial position of the particle?
 - When is the first time the particle is at zero?
 - What is the particle's displacement on the interval from $t = 0$ to $t = 2$ seconds? Include units. Explain what that number means in terms of the particle's starting position.
 - What is the particle's average velocity on the interval from $t = 0$ to $t = 2$ seconds? Include units.
 - What is the particle's speed at $t = 2$ seconds? In which direction is it heading? Include units.
 - What is the particle's acceleration at $t = 2$ seconds? Include units.
 - At what time does the particle turn around?
 - What is the particle's velocity when it is at zero for the second time?
 - What is the particle's name?
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